

# Modeling Emissions for Air Pollution Permits

SBCA-APG4-0601

Any facility engaging in activities that cause air pollution may need an air pollution permit from Wisconsin Department of Natural Resources (DNR). (*Refer to the fact sheets from SBCAAP on permits if you think you might need a permit.*) DNR cannot approve a permit if the source would exceed a National Ambient Air Quality Standard (NAAQS).

The US Environmental Protection Agency (EPA) sets the NAAQS for each criteria pollutant and DNR enforces those standards in Wisconsin. The NAAQS are set to protect human health and welfare concerns. Criteria pollutants are specific compounds EPA has determined to cause human health and welfare concerns at specific levels. Those levels of concern are the NAAQS. To make sure the emissions from the facility will meet the NAAQS, each permit review includes running a computer model that predicts what the impact will be from that facility.

## DNR Models Emissions From a Single Facility

EPA has approved certain computer models used to quantify the impact caused by emissions from a single business. Some of these computer programs are fairly simple for anyone to use (SCREEN3) but give very conservative results, meaning the results are an overestimate of what the actual impact might be. Other computer models are quite complex (ISCST3) but give more accurate results. Copies of these computer programs are available to anyone on EPA's web site.

The DNR modelers use the ISCST3 model. To use this program, the modeler inputs all stack locations at a business into the model. They then input values for emissions of the criteria pollutants (PM, NO<sub>x</sub>, SO<sub>2</sub>, CO) one at a time from each of the stacks. Meteorological data on wind direction and speeds is also used. The computer model does some very complex calculations and determines the point on the ground where the highest impact from one pollutant emitted from all the stacks combined will be found. This impact is the concentration of the pollutant from the business that someone standing at that point will breathe in.

### The NAAQS for each criteria pollutant:

#### Sulfur Dioxide (SO<sub>2</sub>)

80 µg/m<sup>3</sup> - annual average  
365 µg/m<sup>3</sup> - 24-hour average  
1300 µg/m<sup>3</sup> - 3-hour average

#### Particulate Matter (PM)

150 µg/m<sup>3</sup> - 24-hour average

#### Fine Particulate Matter (PM<sub>10</sub>)

50 µg/m<sup>3</sup> - annual average  
150 µg/m<sup>3</sup> - 24-hour average

#### Carbon Monoxide (CO)

10,000 µg/m<sup>3</sup> - 8-hour average  
40,000 µg/m<sup>3</sup> - 1-hour average

#### Nitrogen Oxides (NO<sub>x</sub>)

100 µg/m<sup>3</sup> - annual average

NOTE: The units for the NAAQS are in "micrograms (µg) of the pollutant per cubic meter (m<sup>3</sup>) of air." A microgram is 1/1000 of 1/1000 of a gram. Units in "weight of material per volume of air" is also called the *concentration* of that pollutant in the air. The concentration of a pollutant at ground level, where people can breathe it, is called the *impact level*. The total impact calculated from the business' emissions is then averaged over the specified time periods (i.e., 3-hour avg) and compared against the NAAQS level.

Certain levels of each criteria pollutant exist in the air at all times. Monitors throughout the state have measured the levels of pollutants in the air and DNR calls this existing

level of criteria pollutants the “background” concentration. The modeler **adds** together the impact from the facility, as calculated by the model, with the amount in the background concentration to come up with a total impact.

The total impact is the level of pollution that would be experienced by a person at that point. The model calculates the impact for each hour and the results are then averaged over the specific time period (i.e., 3-hour average). This averaged value is compared against the relevant NAAQS to see if it meets the standard. If a person is standing at the point of highest impact for 3 hours and breathes in an average concentration of 1300  $\mu\text{g}/\text{m}^3$  of  $\text{SO}_2$  per hour for all three hours they may experience irritation of their eyes and nose.

Each of the NAAQS are based on the level of impact of a criteria pollutant, averaged over a certain period of time, that causes health affects in the environment or in humans. Some of the pollutants are a concern at lower levels over a very long period of time (averaged over a whole year), while others are of concern at higher levels for very short periods of time (1-hour or 3-hour averages) and some have multiple levels of concern.

### ***Modeled Emissions Over the NAAQS***

Permit applications require that a facility provides DNR with a plot map, to scale, and the emissions rates for all the stacks to be permitted. These parts of a permit application are passed from the permit writer to a DNR modeler. They run the computer model and send the results to the permit writer. If the total impact of the emissions are greater than the NAAQS, then the permit writer and modeler discuss the options. Some options are easily dealt with by DNR, while others require input by the facility.

### **Limitations on Operations**

The modeling process starts by using the maximum theoretical emissions (MTEs - see *the SBCAAP fact sheet on MTE and PTE Calculations*). If a facility has asked for certain limitations, to avoid a particular requirement, DNR may apply these limitations to the modeled emissions and see if the impact is below the NAAQS. Some limitations that can be used are restrictions on:

- ◆ raw material use,
- ◆ hours of operation, or
- ◆ a certain level of control via a control device (i.e., 90% control by baghouse for PM).

Such limitations often do not solve the problem when applied to the standards with short-term averages. If a facility was exceeding the 3-hour  $\text{SO}_2$  standard, they would probably find it difficult to limit a raw material to a 3-hour limit (i.e., no more than 10 gallons of fuel every 3 hours). Even if a facility hasn’t requested these types of limitations initially, they can be used solely to meet the NAAQS if necessary. In that case the facility would need to write a letter to request such a limitation be put in their permit.

### **Stack Parameters**

One quick option is to change the type of rain diversion equipment installed at the top of a stack. Often facilities have “rainhats” that are fixed just above and completely cover the area above the stack opening. These rainhats do not allow for any vertical dispersion of the pollutants and can result in very high impacts close to the buildings the stacks exhaust from.

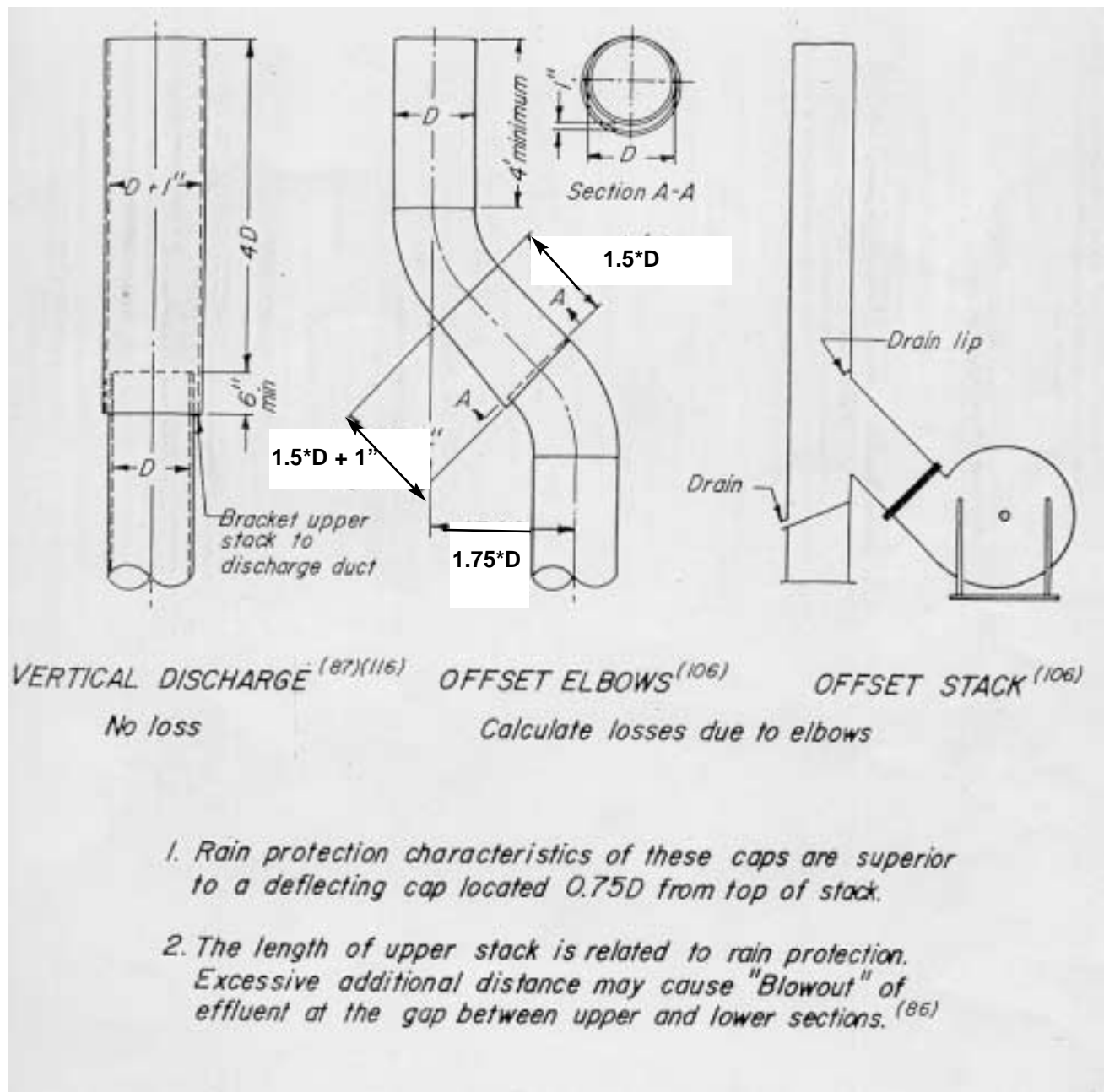
There are three stack configurations (see Figure 1 below) that both divert rain from going down the stack and allow vertical discharge of the exhaust gases. A facility should review these stack configurations and decide whether one is right for them. If one of these can be used, DNR can run the model again to determine if the impact is reduced.

Another option is to increase stack heights and/or decrease stack diameter. These changes to stack design will allow the pollution to be pushed up higher and pulled farther away from the building before coming down to the ground. Impact at ground level is thereby reduced. This option will require more input from the owner or operator of the facility. A consultant may be needed to work through the model a number of times to get just the right mix of stack heights and diameters. DNR will perform a few model runs for each permit, but because of the large backlog of permits they cannot do it indefinitely for a single permit. Often there will also be an engineering element to consider how tall a stack can feasibly get before problems arise.

### ***Permit Requirements***

Once the methods necessary to meet the NAAQS are established, DNR will include those elements in the permit as “enforceable conditions”. Because multiple options exist to allow a facility to meet the NAAQS, an amendment to a permit application requesting that the limits are included in the permit must be submitted. DNR can **only** make suggestions on which option is applied to a facility.

Figure 1: Stack Configurations



### **Contacts for More Information or Assistance.**

The Small Business Clean Air Assistance Program helps smaller businesses understand and comply with the Clean Air Act regulations. Contact one of the program's Clean Air Specialists for more assistance: Renée Lesjak Bashel at 608/264-6153 or Tom Coogan at 608/267-9214.

For further information on modeling contact your DNR Regional or Service Center office shown on the **DNR Contact Fact Sheet** or the DNR's Central office at 608/267-0805.